

EESS Wideband Conference

Stored Mission Data (SMD) Capture
for Coriolis, NPP and NPOESS

Sponsored by Integrated Program
Office

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Mission Enabling Capability

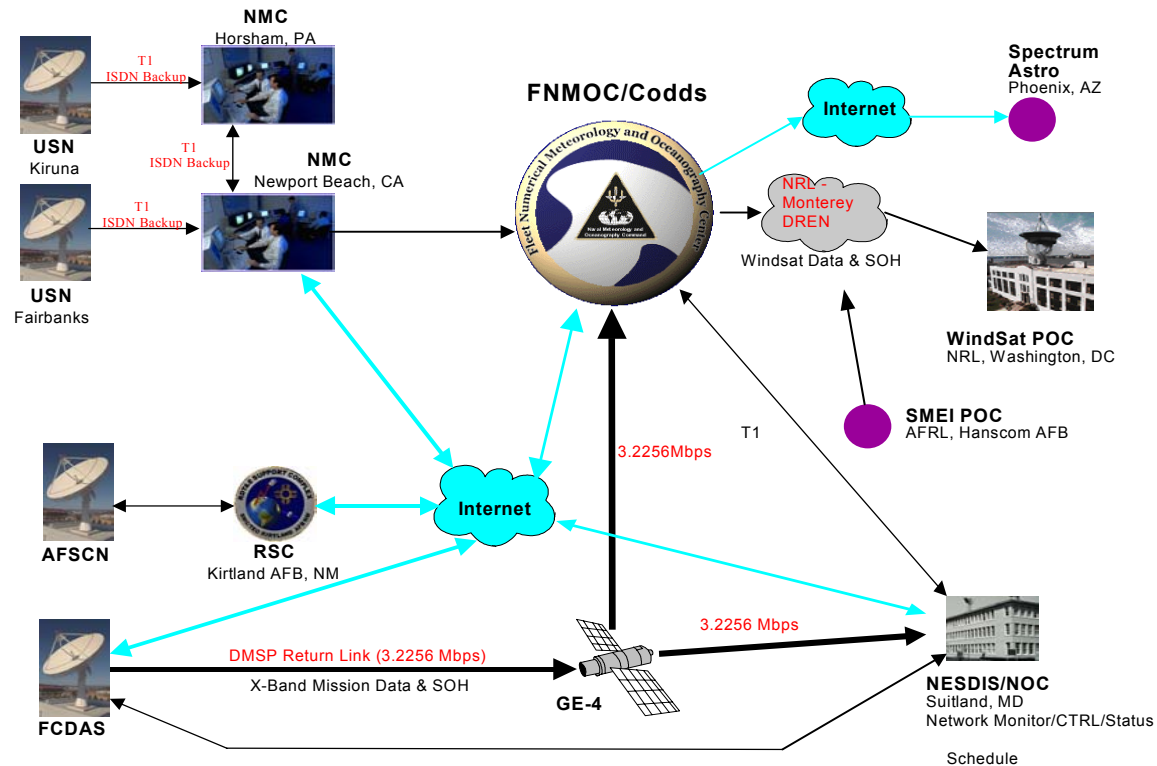
- Recover stored mission data (SMD) from remote sensing, LEO, Weather satellites
- Utilize shared EESS allocation in X-band and Ka-band
- Coriolis – 8.070 GHz @ 25.6 Mbps or 51.2 Mbps .
Mission Ground Stations: Fairbanks CDA and Kiruna, Sweden, 24 hours data latency, 4 contacts per day for 2003 growing to 10 contacts per day in 2004.
- NPP – 8.212 GHz @ 300.0 Mbps MGS: Svalbard, Norway, Data latency: 180 Minutes
- NPOESS – 26.25 GHz @ 150.0 Mbps Mission Ground Stations: 15 locations scattered around the world, data latency 28.3 minutes

Coriolis Mission Description, CONOPS & Status

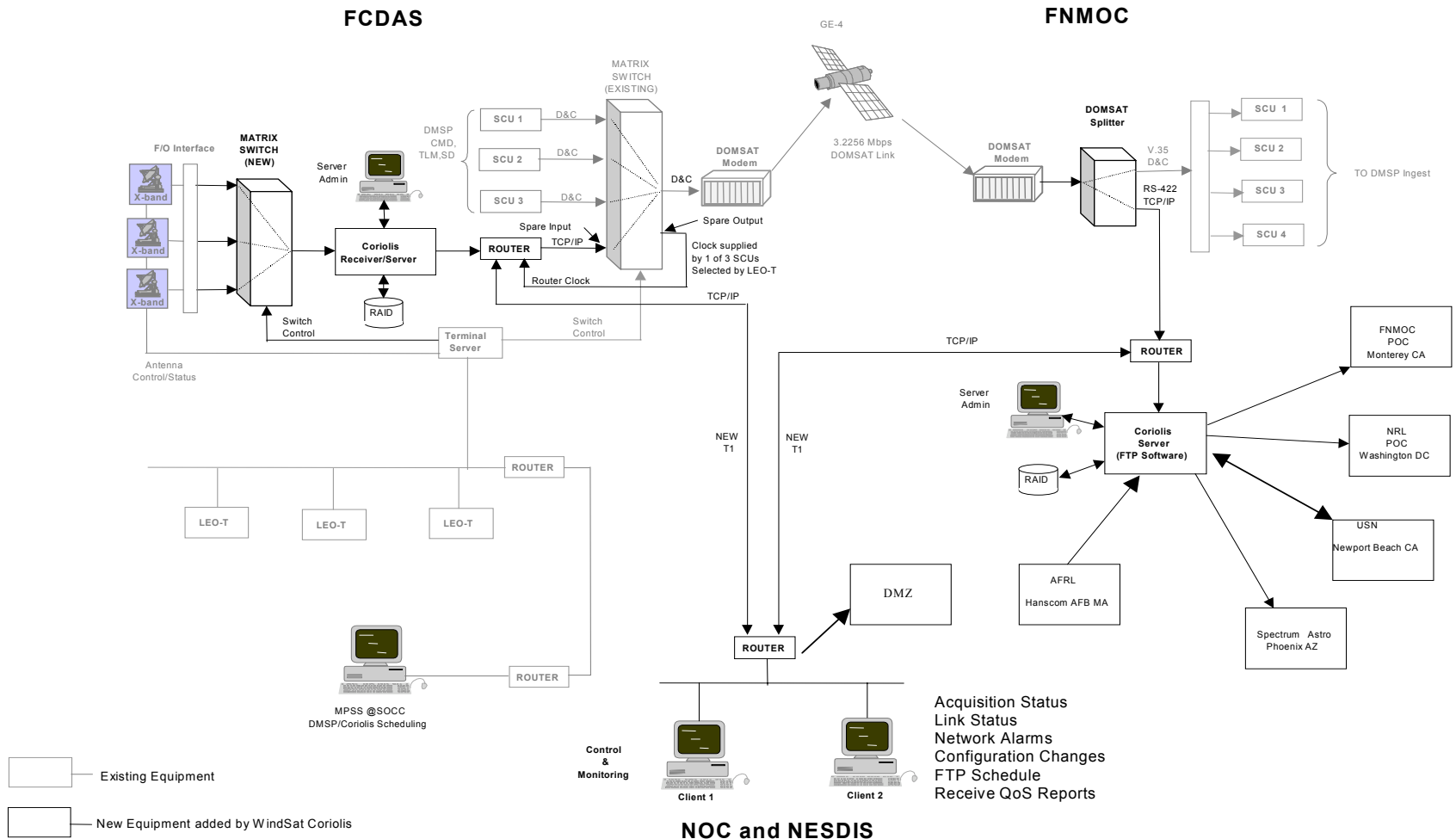
- Description:
 - Spectrum Astro spacecraft bus
 - Instruments: Windsat (NRL) & SMIE (AFRL-Hanscom)
 - CCSDS data packetization
 - LEO orbit, on-board GPS receiver for auto-navigation
- CONOPS
 - Downlink SMD once per orbit: NOAA @ Fairbanks CDA and USN @ Kiruna, Sweden
 - Commanding & telemetry via AFSCN/SGLS
- Status
 - Launched Jan'03
 - X-band SMD recovery functioning
 - Undergoing instrument CAL/VAL

Coriolis SMD Data Routing

Universal Space Network



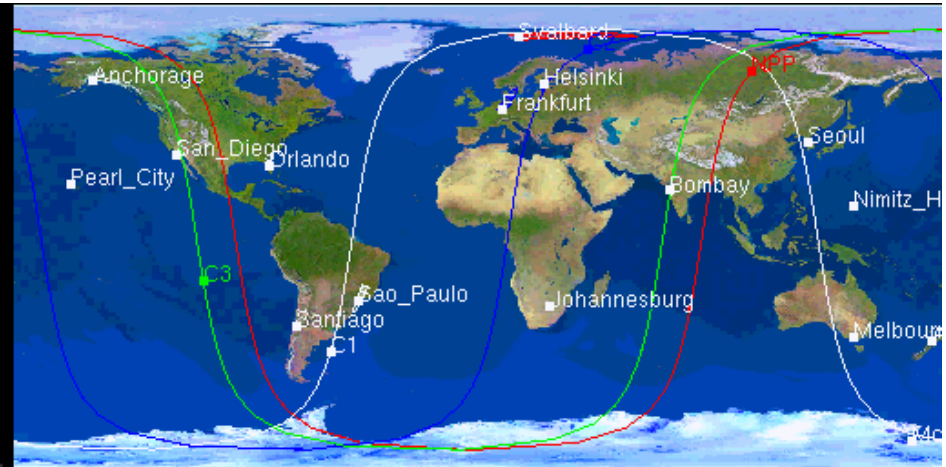
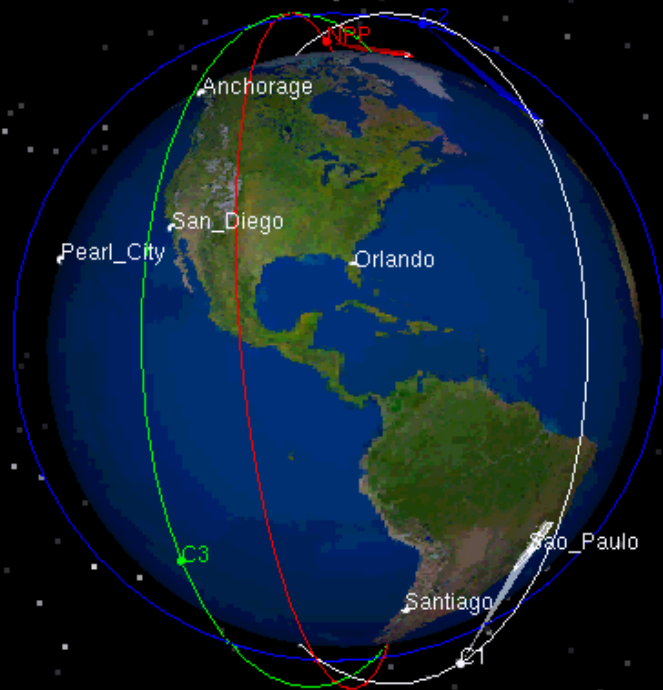
Coriolis SMD Capture and Data Routing Network



Coriolis Stored Mission Data (SMD) Delivery to Nodes – Most Recent Weekly Summary

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Safety Net (Patent Pending) Architecture

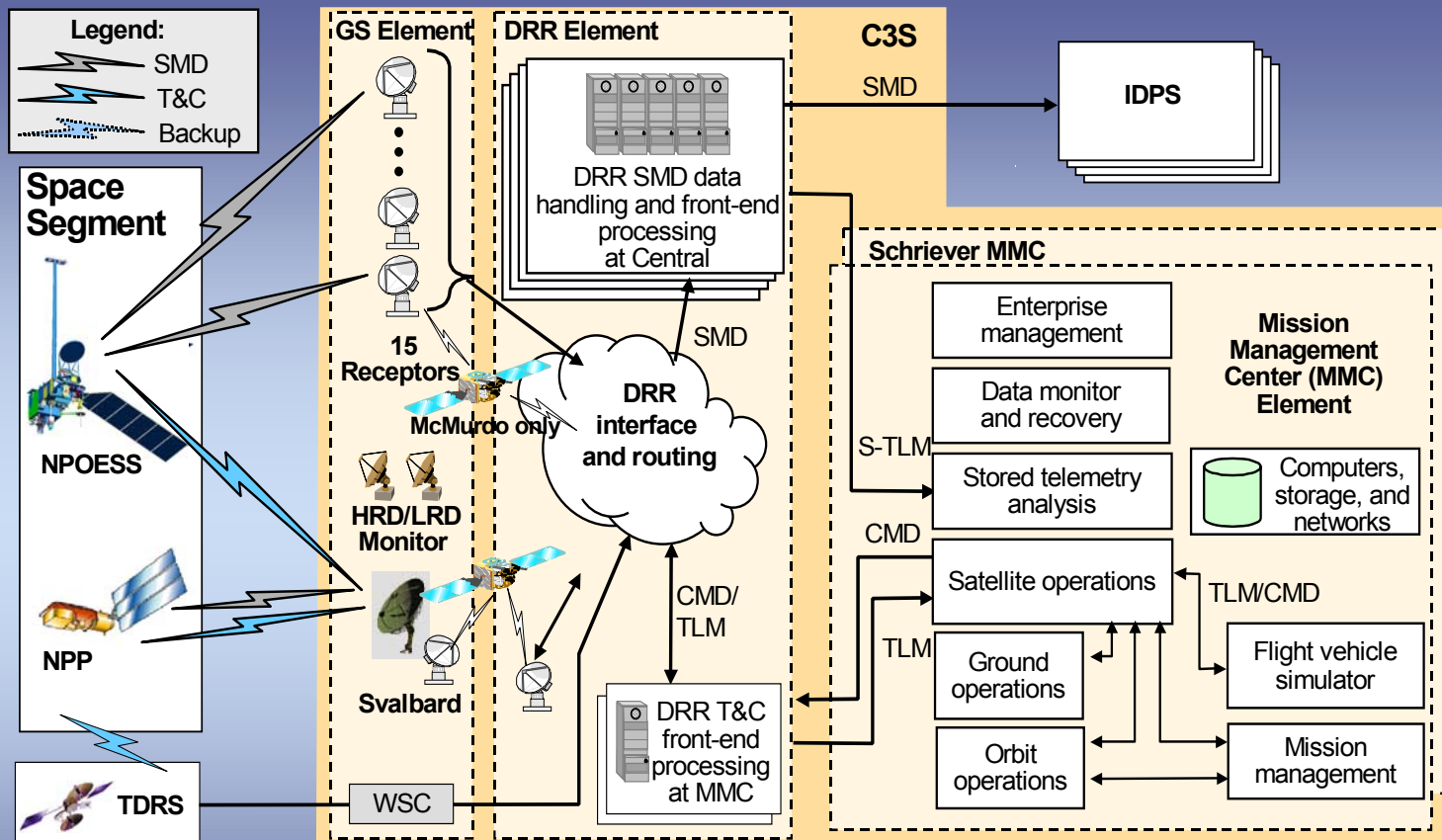


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NPP Mission Description, CONOPS and Status

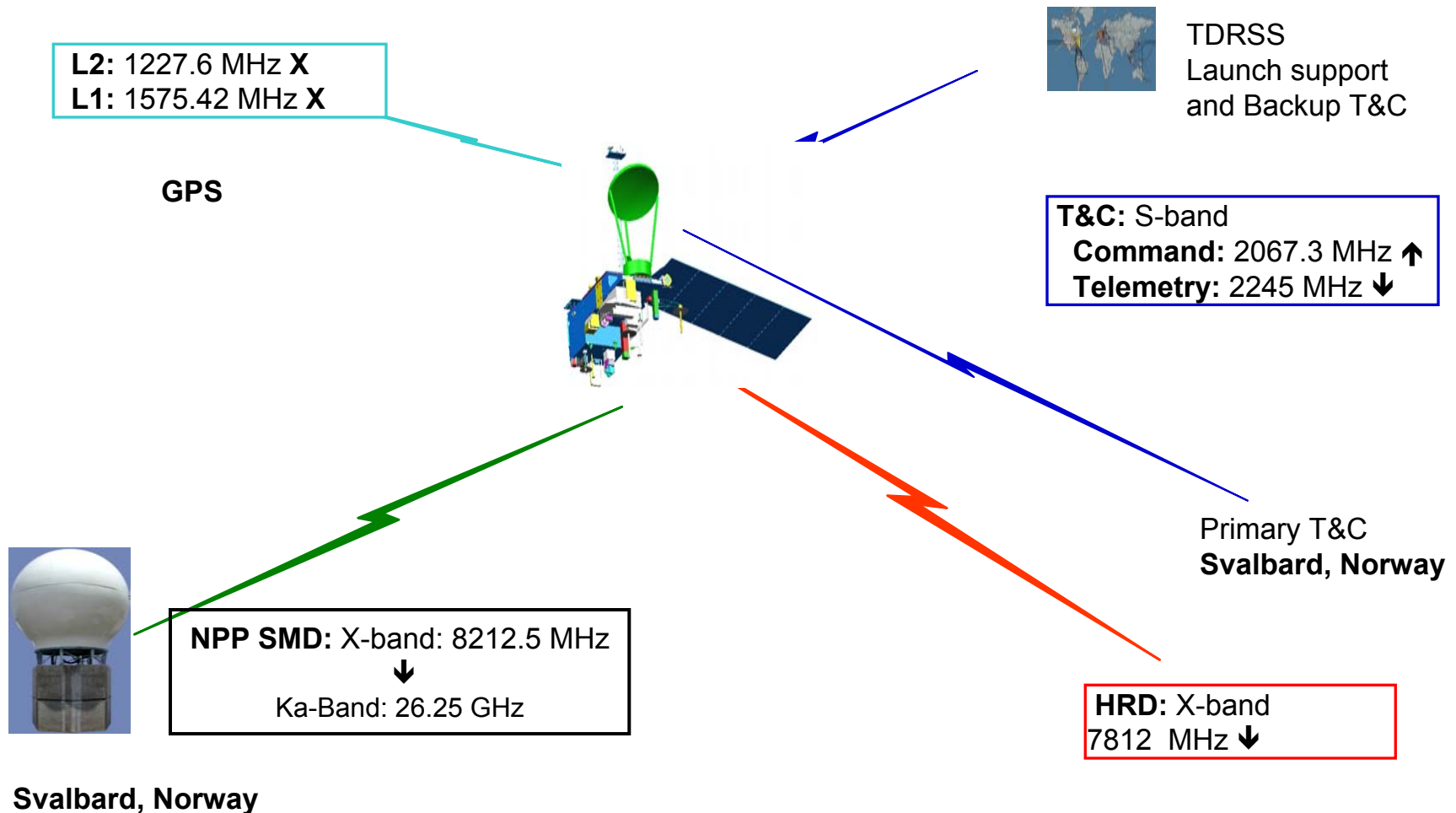
- Description: NPOESS risk reduction
 - Ball spacecraft bus
 - Instruments: VIIRS, OMPS, CrIS, ATMS
 - CCSDS data packetization
 - LEO orbit, on-board GPS receiver for auto-navigation
- CONOPS
 - D/L SMD once per orbit-Svalbard, Norway
 - Commanding via MMC (Suitland, MD) at USB
- Status
 - NTIA Stage 2 approved, ITU API May'02
 - Planned Launch Dec'06
 - SMD recovery @ X-band
 - CDR August'04

C3 Segment Architecture



Low-cost, reliable, and timely data delivery with flexibility to accommodate system growth and technology insertion

NPP RF Link Diagram



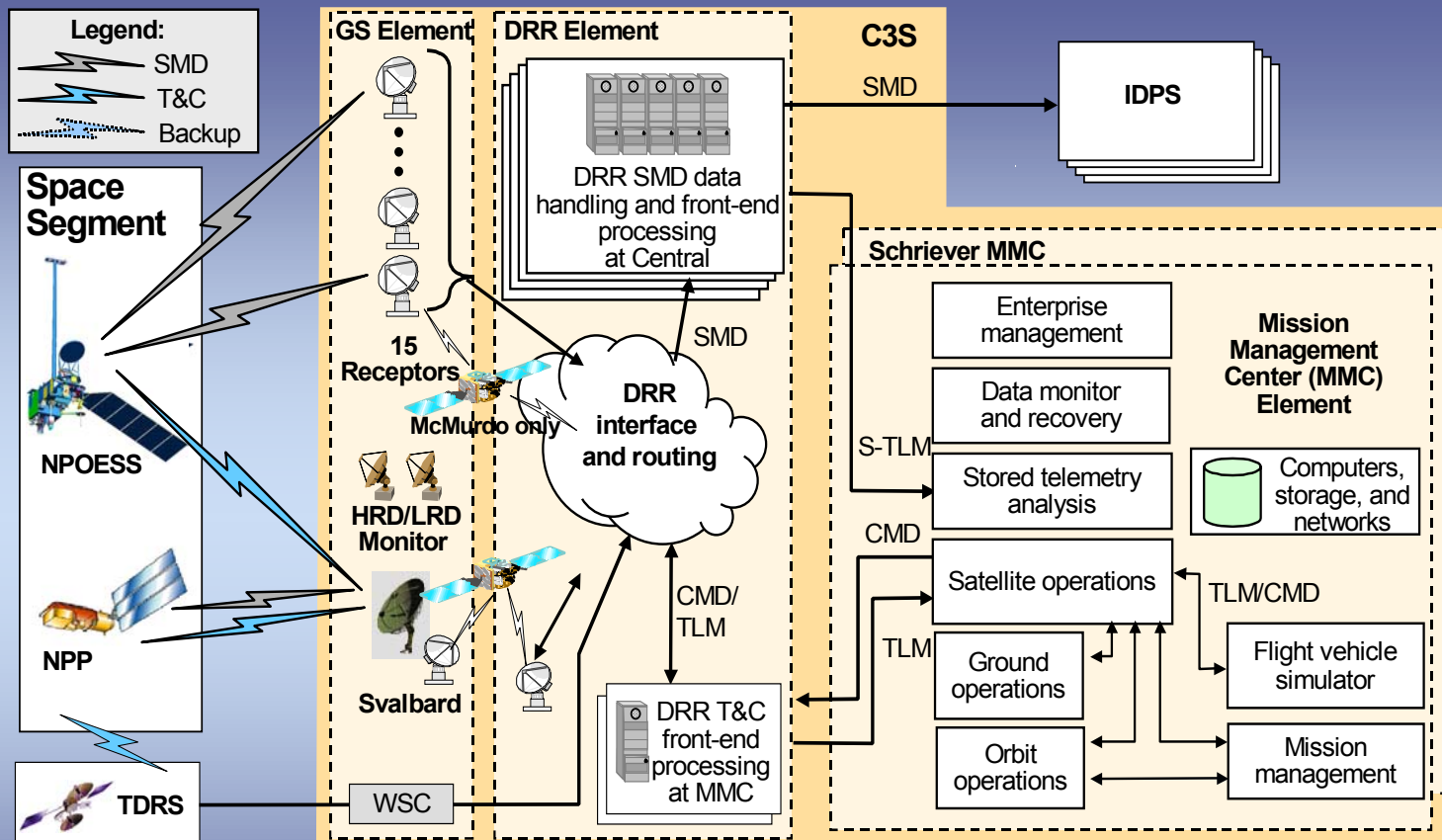
NPP X-band SMD Link

1. Nomenclature/Model Number	SMD X-Band Transmitter	1a. Manufacturer's Name:	Cincinnati Electronics (CMC-EC)
2. System Nomenclature	SMD X-Band Downlink	3. Transmitter Type	Fixed Frequency Power Amplifier
4. Tuning Range	8212.5 MHz	5. Method of Tuning	Fixed
6. R.F. Channeling Capability	N/A	7. Frequency Stability	20 ppm over spacecraft lifetime
8. Emission Designator(s)	300M0G7D	9. Emission Bandwidth: Calculated:	(a) -3 dB 150 MHz (b) -20 dB 280 MHz (c) -40 dB (d) -60 dB 560 MHz
10. Filter Employed	Low Pass Band Pass	12. Maximum Modulation Frequency:	N/A
11. Maximum Bit Rate	262 Mbps	14. Deviation Ratio	N/A
13. Pre-Emphasis	None	16. Pulse Characteristics:	N/A
15. Power (Mean)	8.0 Watts	19. Harmonic Level	(a) 2 nd -60 dB (b) 3 rd -60 dB
17. Output Device:	GaAs FET		
18 Spurious Rejection	53 dB		
20. FCC Type Acceptance No.	N/A		
21. Remarks	Power and bandwidth based upon (255,223) Reed-Solomon coded QPSK Bit rate does not include Reed-Solomon forward error correction (300 Mbps with R-S coding)		

NPOESS Mission Description, CONOPS, and Status

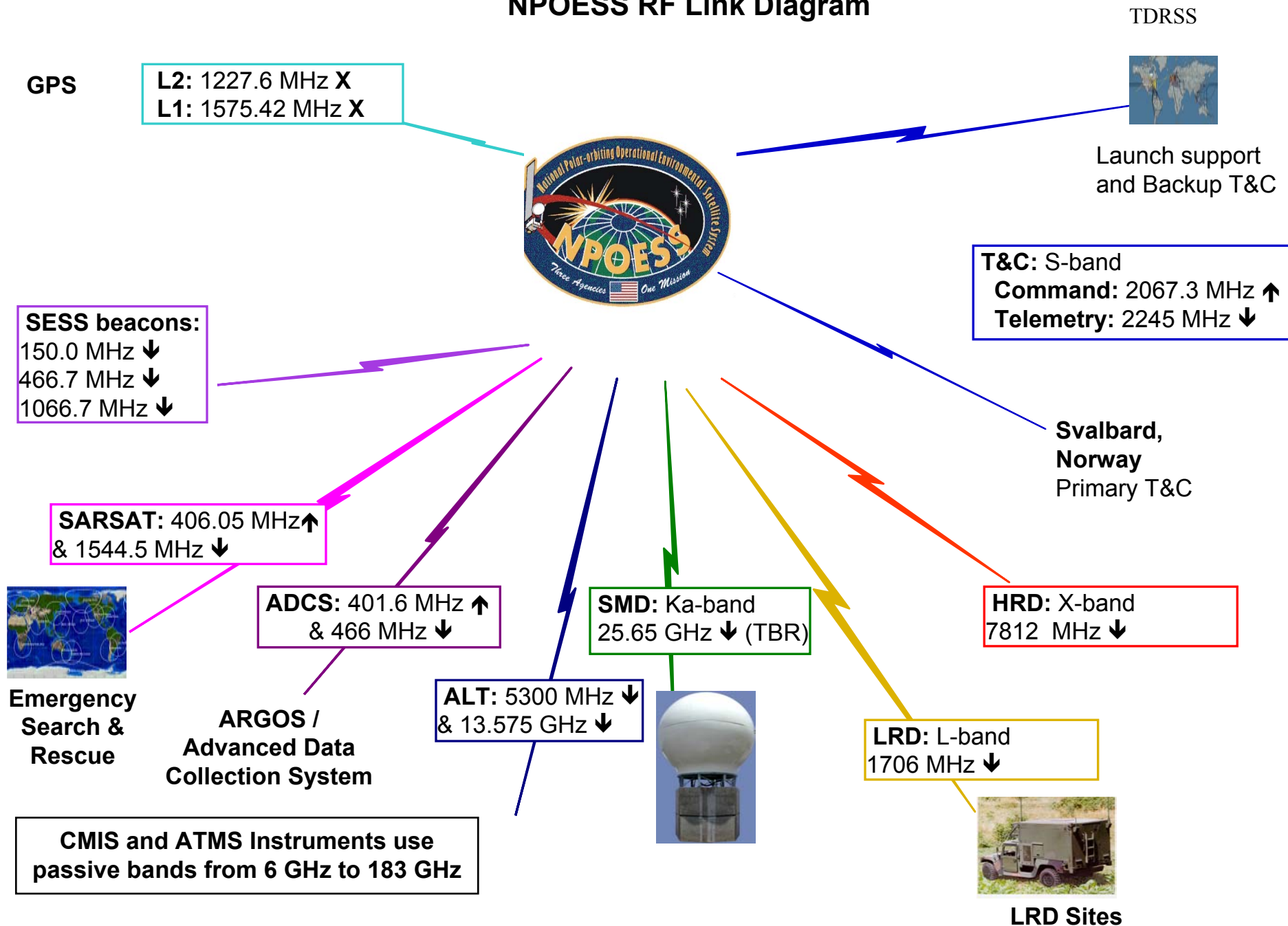
- Description:
 - NGST spacecraft bus/Raytheon Ground system
 - Instruments: VIIRS, OMPS, CrIS, ATMS, plus 10 other instruments
 - CCSDS data packetization
 - LEO orbit, on-board GPS receiver for auto-navigation
- CONOPS
 - Downlink SMD 15 times per orbit via Safety Net nodes
 - Svalbard, Norway commanding / telemetry location
 - TDRSS/White Sands contingency for T&C
 - Commanding via MMC (Suitland, MD) at USB
- Status
 - NTIA Stage 2 approved
 - Planned Launch Dec'10
 - SMD recovery @ Ka-band
 - CDR August'07

C3 Segment Architecture



Low-cost, reliable, and timely data delivery with flexibility to accommodate system growth and technology insertion

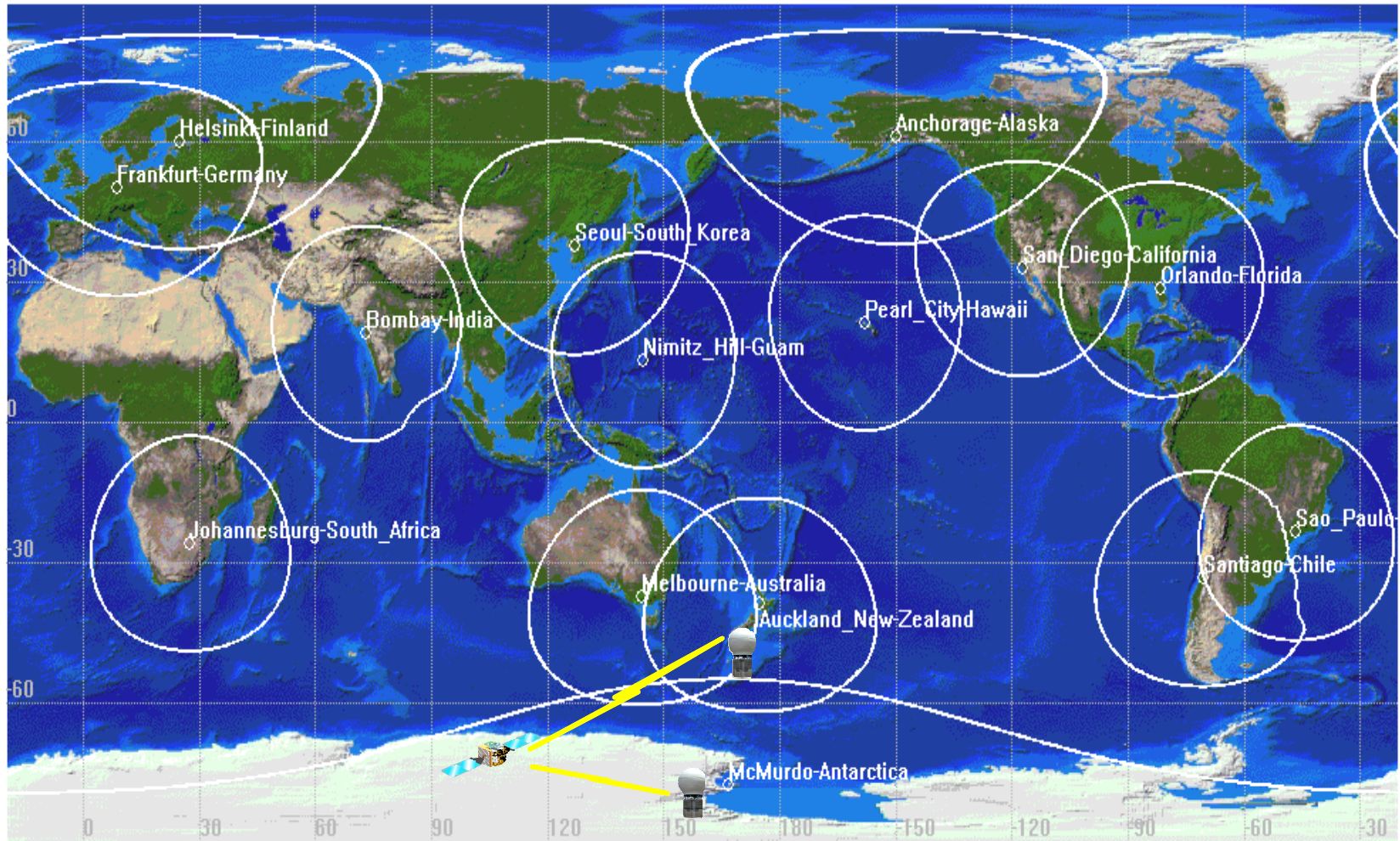
NPOESS RF Link Diagram



NPOESS Ka-band SMD Link

1. Nomenclature/Model Number	SMD Ka-Band Transmitter	1a. Manufacturer's Name:	TBD
2. System Nomenclature	SMD Ka-Band Downlink	3. Transmitter Type	Fixed Frequency Power Amplifier
4. Tuning Range	25500-27000 MHz	5. Method of Tuning	Fixed
6. R.F. Channeling Capability	N/A	7. Frequency Stability	2 ppm per year
8. Emission Designator(s)	300M0G7D	9. Emission Bandwidth: Calculated:	(a) -3 dB 230 MHz (b) -20 dB 510 MHz (c) -40 dB 1630 MHz (d) -60 dB 4530 MHz
10. Filter Employed	Band Pass	12. Maximum Modulation Frequency:	N/A
11. Maximum Bit Rate	131 Mbps	14. Deviation Ratio	N/A
13. Pre-Emphasis	None	16. Pulse Characteristics:	N/A
15. Power (Mean)	5.5 Watts (input to antenna)	19. Harmonic Level	(a) 2 nd -60 dB (b) 3 rd -60 dB
17. Output Device:	Helical TWT		
18 Spurious Rejection	60 dB		
20. FCC Type Acceptance No.	N/A		
21. Remarks	Item 4: Center Frequency to be determined during Coordination Item 8: Bandwidth includes effects of $r=1/2$, $k=7$ Viterbi and (255, 223) Reed-Solomon FEC coding. Item 11: Bit rate does not include FEC (300 Mbps with R-S and Conv. coding)		

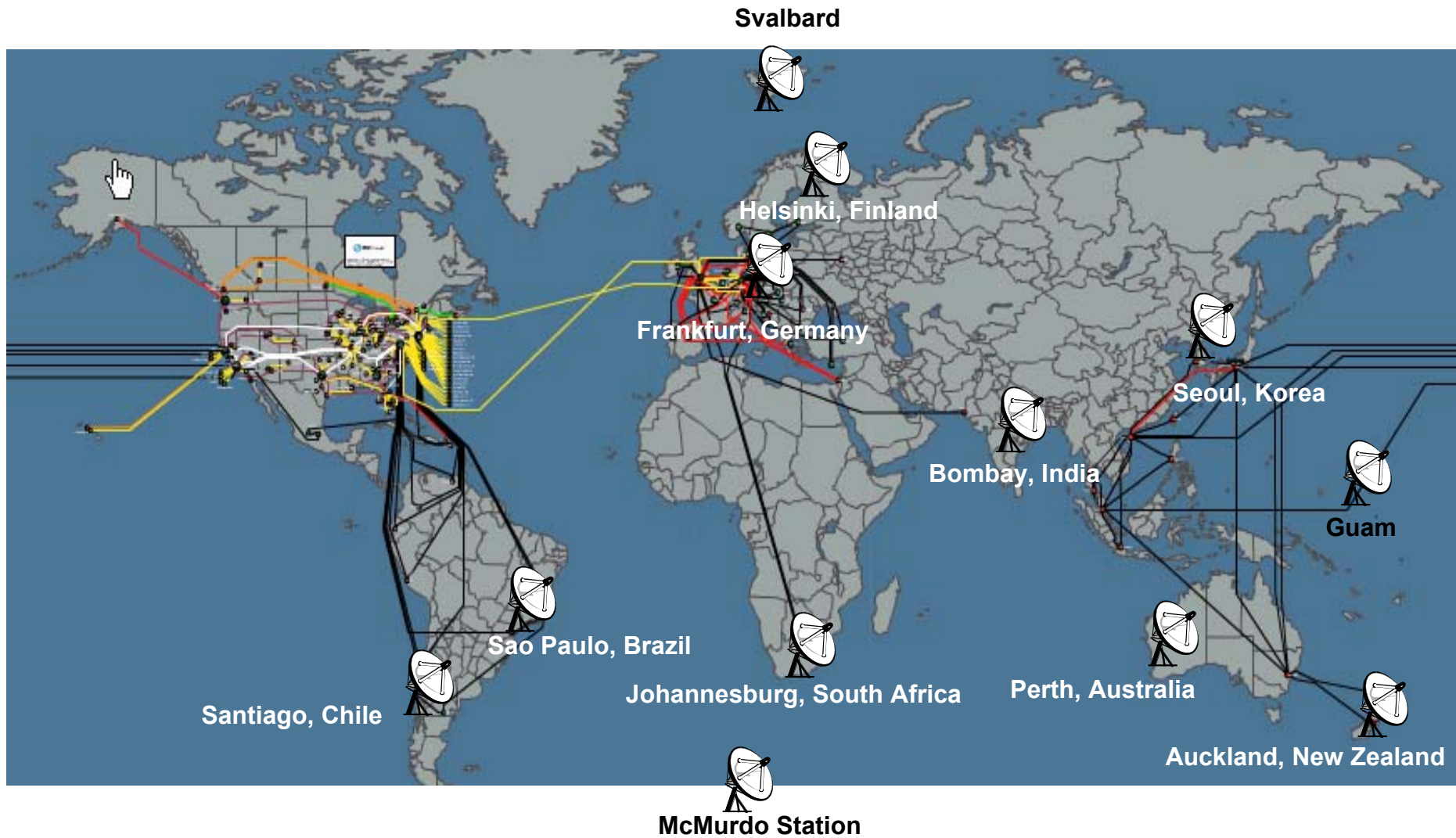
Safety Net* (Patent Pending) Architecture



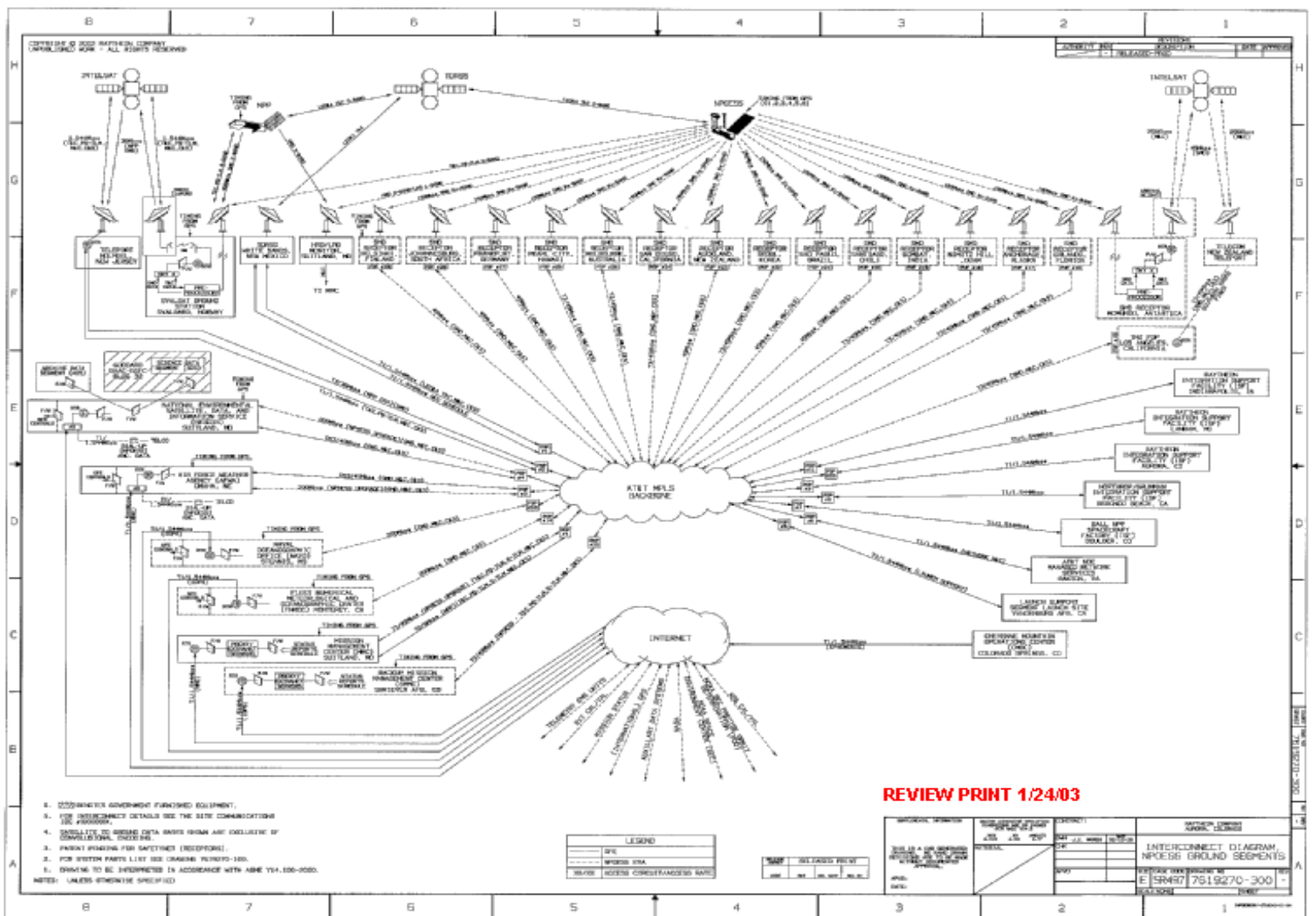
SafetyNet* -- 15 globally distributed SMD receptors linked to the centrals via commercial fiber -- enables low data latency and high data availability

NPP/NPOESS Site Locations

OCONUS Sites



NPP/NPOESS Interconnect Architecture



Summary

- Planned use of EESS allocations to support next generation of Wx satellites
- Multi-mission ground sites
- CCSDS AOS Grade 2 Data Packetization
- Improved resolution, EDR attribute accuracy, and data latency